

## A TAXONOMIC REVISION OF *PHYSARIA* (CRUCIFERAE) IN UTAH

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ABSTRACT.— The *Physaria* species which occur in Utah are revised. This study is based on the treatment of this genus by Rollins (1939) and Mulligen (1967). Keys, descriptions, distribution maps, herbarium specimen citations, and discussions of the taxonomy of the genus are presented.

The genus *Physaria* is confined to western North America. It occurs in the upper sonoran, transition, montane, and lower Canadian life zones, chiefly on high plateaus and lower mountain elevations (Rollins, 1939). This distribution extends from the southwestern United States to the Canadian border and from the Great Plains to the Sierra Nevada and Cascade mountain ranges. The genus, according to Rollins (1939), is of very recent origin. Mulligen (1967) verifies this view with studies he conducted using chromosome counts. He infers from his chromosome studies that several species are so closely related that a single species could include them all. One such cluster includes three of the four species which occur in Utah: *P. acutifolia*, *P. chambersii*, and *P. newberryi*. The other closely related species which belong to the group are *P. didymocarpa*, *P. bellii*, *P. rollinsii*, *P. brassicoides*, *P. condensata*, and *P. floribunda*. Since morphological characteristics distinguish these groups and all species within them are virtually isolated geographically, Mulligen (1967) believes they should be retained as individual species.

Some integration can be observed morphologically in southern Utah between *P. chambersii* and *P. acutifolia*. Integration is also evident between *P. chambersii* and *P. newberryi* in the extreme southern counties of Utah.

Mulligen (1967) corrected the name applied by Rollins (1939) to the *Physaria* of eastern Utah from *P. australis* to *P. acutifolia*. This was due to specimens studied from Colorado which have since been named *P. rollinsii* (Mulligen, 1966).

Rollins described *P. chambersii* var. *membranacea* from specimens taken from Red Canyon, 16 miles west of Bryce Canyon National Park, Garfield County, Utah. The classification was based on the membranaceous nature of the siliques. Plants taken from this region and cultivated in different soils and environmental conditions showed a wide variation in the texture of the valves. Mulligen (1967) concluded that the specimens treated as var. *membranacea* did not, therefore, warrant varietal status.

Specimens examined in this study are in the herbaria of Brigham Young University (BRY), Utah State University (UTC), and the University of Utah (UT). Those labeled only as *Physaria* sp. were lacking fruits and were not included in citations.

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*Physaria* inhabits dry barren regions where sunlight is intense and competition is minimal. The adaptation of this plant to survive xeric conditions is reflected in the heavy pubescence on the gray green leaves.

*Physaria* (Nutt.) Gray

Perennial, caespitose, silvery stellate; stems simple, arising laterally on a somewhat elongated caudex; basal leaves usually numerous, often terminating the caudex or its branches in rosette form, petiolate oblanceolate to obovate or the blade rotund, entire dentate, or divided into segments; cauline leaves present, usually few, entire or dentate; inflorescence congested to somewhat elongated, usually elongating in fruit; pedicels rigid; sepals linear-oblong, pubescent, often cucullate at apex; petals yellow or rarely purplish, usually spatulate, glabrous; siliques didymous, pubescent, often highly inflated, apical sinus present; ovules 2-6 in each loculus; style persistent; seeds brown wingless.

KEY TO THE SPECIES KNOWN IN UTAH

1. Style less than 3.5 mm long ..... *P. newberryi*  
 Style more than 4 mm long ..... 2
- 2(1). Sinuses of silique equal above and below, valves nearly orbicular ..... *P. acutifolia*  
 Sinuses of silique equal above and below, valves not as above ..... 3
- 3(2). Silique highly inflated, 1.5-3 cm wide, valves membranaceous ..... *P. chambersii*  
 Silique moderately inflated less than 1.5 cm, plants loosely pubescent ..... *P. grahamii*

*Physaria acutifolia* Rydb.

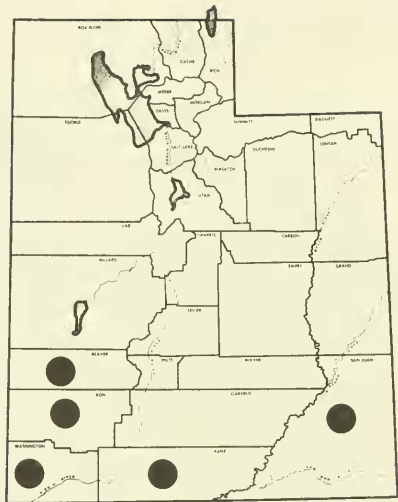
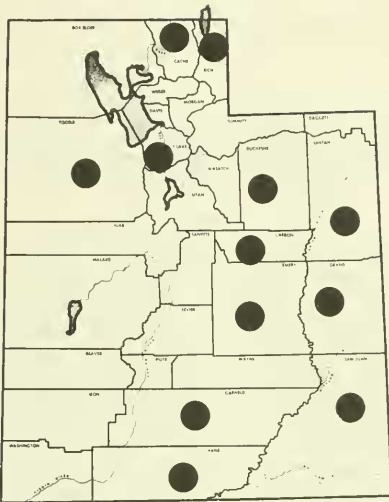
*Physaria acutifolia* Rydb., 1901, Bull. Torr. Bot. Club 28:279.

*Physaria didymocarpa* (Hook.) Gray var. *australis* Payson. 1918, Ann. Gard. 5, 144.

*Physaria australis* (Payson) Rollins, 1939, Rhodora 11, 408.

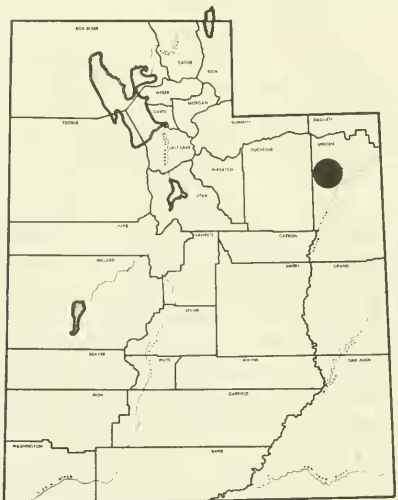
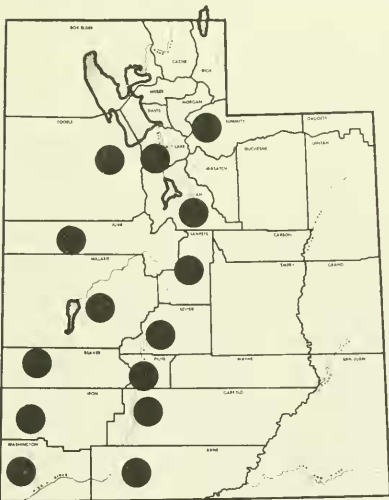
DESCRIPTION.— Small, tufted perennial with a deep, rather slender taproot; basal leaves numerous 1.5-2 cm long, oblanceolate or obovate, acute entire or slightly wavy and very finely stellate stem; leaves rather few, oblanceolate; flowering stems 4-6 cm long, ascending or depressed; fruit small, obtuse or slightly cordate at the base, deeply divided above; cells inflated almost spherical, 4-6 mm in diameter; style about 5 mm long. This species differs from *P. didymocarpa* in its smaller acute leaves and in its smaller fruit, which is more deeply divided above as well as below.

The siliques are characteristic features of this species, being highly inflated and strongly contracted toward the replum. The



1. *Physaria acutifolia* Rydb.

2. *Physaria newberryi* Gray



3. *Physaria chambersii* Rollins

4. *Physaria grahamii* Morton

Figs. 1-4. *Physaria* distribution in Utah: 1, *P. acutifolia* Rydb.; 2, *P. newberryi* Gray; 3, *P. chambersii* Rollins; 4, *P. grahamii* Morton.

apical and basal sinuses are well developed and almost equal. The valves are rounded.

DISTRIBUTION.— This species grows in eastern Utah in dry, sparsely populated plant communities at ranges from 2,000 feet up to 9,000 feet in elevation. Members of the genus are found outside of Utah in northwestern New Mexico, western Colorado, southeastern Idaho, and most of Wyoming.

Specimen citations include the following counties: Grand, B. F. Harrison 5968, 9-V-1933 (BRY); San Juan, S. L. Welsh 2898, 31-V-1964 (BRY); Uintah, S. L. Welsh 49, 29-IV-1955 (BRY); Emery, B. F. Harrison 8076, 8-V-1936 (BRY); Kane, J. R. Murdock 403, 3-V-1962 (BRY); Carbon, N. D. Atwood 1300, 29-IV-1968 (BRY); Garfield, B. Maguire 19,098, 25-VI-1940 (UTC); Duchesne, A. O. Garrett 7784, 19-VII-1938 (UT); Salt Lake, A. O. Garrett 6355a, 28-VI-1933 (UT); Tooele, J. Reveal 191A, 15-VI-1961 (UTC); Rich, J. W. Harrison no number, 24-VI-1927 (UT) (labeled as Cache County); and Cache, S. Flowers 223, VI-1924 (UT). Note: The University of Utah specimens used here were labeled by the previously used name of *P. australis* or, in some instances, by the name of *P. didymocarpa*, which is not known to grow in Utah.

### *Physaria newberryi* Gray

*Physaria newberryi* Gray, 1860, in Ives' Report Colo. River, pt. 4, 6.

*Coulterina newberryi* (Gray) O. Kuntze, 1891, Revis. Gen. 2, 931.

*Physaria didymocarpa* (Hook.) Gray var. *newberryi* (Gray) Jones, 1895, Proc. Calif. Acad. Sci. 2, 5.

DESCRIPTION.— Perennial, caespitose, silvery stellate throughout; caudex simple branched; stems several to numerous, erect, simple, arising laterally, 0.5-1 dm long including the fruiting raceme; basal leaves obovate, incised, or merely dentate with broad teeth, slender petioled, 4-8 cm long, 3-4 mm wide; petals yellow ligulate, often truncate at apex, 10-13 mm long, 2-3 mm wide; fruiting raceme dense, 3-5 cm long; pedicels rigid, straight, divaricate, 5-10 mm long; siliques didymous, highly inflated, apical sinus broad, the shoulders angular and evenly compressed with appressed stellae; valve keeled on both outer margins, each valve 8-12 mm wide, 12-16 mm long; replum linear, acute at apex, 8-10 mm long, 1-1.5 mm wide; style 2-3 mm long; ovules 2-4 in each locule; seeds obovate, light brown marginless, 2-3 mm wide, 3-4 mm long.

DISTRIBUTION.— This species is found only in the extreme southern part of Utah growing in dry, open areas. It is found in north central and northern Arizona and in the extreme northwestern part of New Mexico. The distinctive characteristics of this species are its V-shaped apical sinus, short style, and straight-sided silique.

Specimen citations include the following counties: Washington, S. L. Welsh and G. Moore 6865, 6-IV-1968 (BRY); Iron, W. P. Cotnam 4724, 22-IV-1930 (UT); San Juan, B. F. Harrison 11600, 19-V-

1950 (BRY); Kane, Cottam 4289, 12-VI-1929 (BRY); and Beaver, Cottam 8032, 8-VI-1940 (UT) (labeled as *P. didymocarpa*).

*Physaria chambersii* Rollins

*Physaria chambersii* Rollins, 1939, Rhodora 41, 403.

*Physaria chambersii* var. *membranacea* Rollins, 1939, Rhodora 41, 405.

DESCRIPTION.— Perennial, caespitose, silvery stellate throughout; stems numerous from a simple caudex, arising laterally, erect or very often decumbent, simple, 5-15 cm long including the fruiting raceme; radial leaves entire or dentate, obovate to orbicular, slender petioled, 3-6 cm long, 1-2 cm broad; cauline few, entire, spatulate, often acute, 1-2 cm long, 3-6 cm wide; inflorescence rather lax; sepals linear-oblong, pubescent 6-8 mm long, 1 mm wide; petals yellow, spatulate, 10-12 mm long, 3-4 mm wide; fruiting raceme congested, 2-10 cm long; pedicels divaricate, slightly sigmoid, 8-15 mm long; siliques didymous, greatly inflated, evenly and often densely pubescent, often purplish at maturity, obtuse to slightly cordate at base; apical sinus deep and open, crests rounded; valves subreniform, each valve 1-1.5 cm long, 1 cm wide; style 6-8 mm long; ovules 2-6 (mostly 4) on each side of the replum; seeds orbicular, flattened brown, 2-3 mm broad, 2-4 in each loculus margin.

*P. chambersii* is related to *P. newberryi* but differs in having round-sided siliques and apical margins, a cordate or nearly truncate base, sinus crests rounded, style 8-13 mm long and replum 3-6 mm long compared to keeled apical margin siliques, truncate base, sinus crests decidedly angular, style 2-3 mm long, replum 8-10 mm long with acute apex and straight-sided valves for *P. newberryi*.

DISTRIBUTION.— This species is found in the western half of Utah, most of Nevada, northwestern Arizona, extreme southeastern Oregon, and southwestern California.

Specimen citations include the following counties: Utah, B. F. Harrison 8326, 18-V-1938 (BRY); Juab, W. P. Cottam 7187, 28-V-1937 (UT);\* Tooele, C. Edwards 123, 15-V-1968 (BRY); Garfield, W. O. Stanton 153, 28-VI-1930 (BRY); Sanpete, A. O. Garrett no number, 29-IV-1911 (BRY); Kane, Cottam 4289, 12-VI-1929 (UT); Summit, S. L. Welsh 6263, 20-VI-1967 (BRY); Millard, W. P. Cottam 7347, 14-V-1939 (UT);\* Washington, P. Plummer 5429, 9-V-1939 (UT);\* Sevier, R. Stevens 134, 10-IV-1966 (BRY); Beaver, M. Milner 9212, 30-IV-1946 (UT); Iron, Cottam 3922, 31-V-1926 (BRY); Piute, W. P. Cottam 7005, 15-V-1936 (UT);\* and Salt Lake, S. Flowers 1390, 1927 (UT). Plants marked with an asterisk(\*) were mislabeled as *P. didymocarpa*.

A specimen labeled A. O. Garrett 8333a, 9-VI-1940 (UT), from Duchesne County, was sent to Reed Rollins, who stated in a letter now in the herbarium that this is a new species closely related to *P. oregoni* or a variety of the same. However, *P. oregoni* is found no farther south than central Idaho. No further information was available concerning this specimen.

*Physaria grahamii* Morton

*Physaria grahamii* Morton, 1937, in Ann. Carneg. Mus. 26:220.

DESCRIPTION.— Perennial, caespitose, densely pubescent throughout with spreading stelae; stems simple, somewhat decumbent, about 1.5 dm long; basal leaves numerous, broadly oblanceolate to broadly spatulate, obtuse irregularly pinnatifid, 10-15 cm long, about 3 cm broad, distal lobes large and variable, cauline, few, dentate or rarely entire; pedicels divergent, 5-15 mm long; sepals linear-oblong, pubescent, about 5 mm long; petals yellow, spatulate, 6-8 mm long; siliques erect, didymous, inflated but not highly so, shallow sinus below, deep sinus above; replum linear-oblong, somewhat constricted, ovules 2 on each side; style 6-8 mm long; mature seeds unknown.

The type of this species is not altogether satisfactory because the fruits are immature. Its distinctiveness rests upon the fact that the entire plant is covered with loose, spreading stelae and large basal leaves deeply lobed along the margins. *P. grahamii* is at present known only from the type collection.

DISTRIBUTION.— This species is known from specimens collected at Chandler Canyon, Uinta Basin, Uintah County, Utah, 3-VIII-1935. Graham 9976 (us type).

## REFERENCES

- INDEX KEWENSIS. 1895 to present. Clarendon Press, Oxford, England.
- KEARNEY, T. H., AND R. H. PEBBLES. 1951. Arizona Flora. University of California Press, Berkeley and Los Angeles.
- MULLIGEN, G. A. 1966. Two new species of *Physaria* (Cruciferae) in Colorado. Can. J. Bot. 44:1661-1665.
- . 1967. Cytotaxonomy of *Physaria acutifolia*, *P. chambersii*, and *P. newberryi* (Cruciferae). Can. J. Bot. 45:1887-1898.
- ROLLINS, R. C. 1939. The cruciferous genus *Physaria*. Rhodora 41:392-415.
- TIDESTROM, I. 1925. Flora of Utah and Nevada. Government Printing Office, Washington, D.C.
- WELSH, S. L., AND M. TRESHAW AND G. MOORE. 1964. Guide to common Utah plants. Brigham Young University Press, Provo, Utah.